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Statement of

Dr. Robert Pappalardo
Europa Mission Project Scientist
Jet Propulsion Laboratory
National Aeronautics and Space Administration

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Committee on Science, Space and Technology
U.S. House of Representatives

Chairman Smith, Ranking Member Johnson, and other Members of the Committee, I am very happy to appear before you to discuss NASA's Europa project.

Jupiter's moon Europa is one of the most likely places to find current life beyond our Earth. For over 15 years, NASA has studied a variety of mission concepts to explore Europa and determine if it could be habitable. Key scientific interests include the characteristics of Europa's vast ocean, the interface between the ice and the ocean, the chemical composition of its intriguing brownish surface areas, and the current geological activity that provides energy to the system.

My own fascination with the ice-covered moons of the outer solar system blossomed in 1985, with a seminar course at Cornell University taught by Carl Sagan entitled "Ices and Oceans in the Outer Solar System." Though I was just an undergraduate, Sagan allowed me to audit this graduate course. In some sparkling moments, Sagan was as brilliant a teacher as one could imagine, and inspired what would become my career.

I joined my first Europa mission Science Definition Team in 1998. Now, working at NASA's Jet Propulsion Laboratory, I am the Project Scientist for the burgeoning Europa mission, serving as the interface between the engineering team and the recently selected science team.

Europa Science

In the late 1990s, NASA's Galileo mission to Jupiter produced strong evidence that Europa--about the size of Earth's moon--has a global ocean beneath its frozen crust. This ocean could contain more than twice as much water as Earth. With abundant salt water, a rocky sea floor, and the chemical energy that could potentially be transported to the

ocean by processes powered by tidal heating, Europa might have the ingredients needed to support simple organisms.

Europa's tidal heating stems from interplay with its neighboring moons Io and Ganymede. What this means is that every time Europa completes one orbit of Jupiter, it aligns with Io, and every second orbit, it aligns with Ganymede. Gravitational interactions among these moons keep their orbits slightly elliptical. So throughout each Europa orbit, the distance to Jupiter changes, raising tidal bulges that constantly modify Europa's global shape. Europa's rich and diverse geology, and its probable subsurface liquid water ocean, are both believed consequences of the strong tides that heat the interior and flex the surface to its breaking point.

Europa's chaotic terrains—regions of disrupted surface ice—display similarities to features in Antarctica, suggesting that they could be surface manifestations of shallow subsurface lakes. If that is true, these lakes are possible abodes for life at Europa. Europa's chaotic regions are commonly brownish-red in color, with infrared signatures that are suggestive of salts, probably derived from the ocean below.

NASA's Europa Mission

NASA's Europa mission plan calls for a spacecraft to be launched to Jupiter in the 2020s, arriving at the distant planet after a journey of several years. The current plan envisions a spacecraft that would have an expected lifetime of more than three years and would orbit the giant planet on average about every two weeks, providing many opportunities for close flybys of Europa. Building on technologies and techniques developed for the Cassini and Juno missions, the current mission plan includes 45 flybys, at altitudes varying from 1,700 to just 16 miles above the surface. During these flybys, the spacecraft would achieve near global coverage, image the moon's icy surface at high resolution, and investigate its composition and the structure of its ocean and icy shell.

NASA announced the instruments for the Europa mission's scientific payload on May 26. The payload of nine selected science instruments includes cameras and spectrometers that will produce high-resolution images of Europa's surface and determine its detailed composition. An ice-penetrating radar can determine the thickness of the moon's icy shell and search for subsurface lakes, similar to those beneath Antarctica. The mission also will carry a magnetometer to measure strength and direction of the moon's magnetic field, which will allow scientists to probe the thickness and saltiness of its ocean.

A thermal instrument will scour Europa's frozen surface in search of recent eruptions of water or warm ice, while additional instruments will sample tiny particles of water, dust, and plasma in the moon's extremely thin atmosphere. NASA's Hubble Space Telescope observed water vapor above the south polar region of Europa in 2012, providing tantalizing evidence of water plumes. If plumes are confirmed – and if they can be linked to the subsurface ocean – it will allow us interrogate the chemical makeup of Europa's potentially habitable subsurface environment, while minimizing the need to drill into the ice.

Just last month, NASA completed its first major review of the Europa flyby mission, which has now entered the development phase known as formulation. During the remainder of 2015 and through FY 2016, the project will work to develop science requirements, mission architecture, planetary protection requirements, risk identification and mitigation plans, cost and schedule estimates, as well as payload accommodation for the mission to Europa.

In short, NASA is formulating a project that could lead to fundamental discoveries about Europa. This is will be both an ambitious and an exciting undertaking. Just as with that graduate Carl Sagan course that I took at Cornell, this mission will be at the cutting-edge of science and engineering, and is sure to inspire the next generation.

Thank you, and I look forward to any questions you might have.